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MOTOR VEHICLE MANUFACTURING IN THE UNITED STATES

Some Basic Economic Aspects

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Motor Vehicle Manufacturing
In The United States

Some Basic Economic Aspects

Automobile Manufacturers Association, Inc.
320 New Center Building, Detroit 2, Michigan

FOREWORD

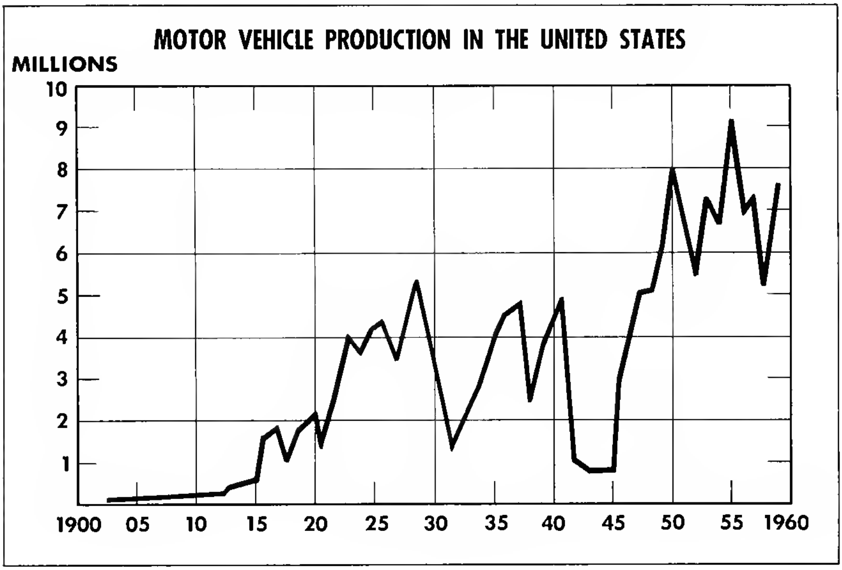
A committee of automobile industry executives prepared this paper for presentation to a group of Russian economists who toured the United States in the fall of 1959.

Many others studying the economy of the United States in general or the automobile manufacturing industry in particular will be interested in the material covered by this presentation. It, therefore, has been reproduced in this booklet form, substantially as originally presented, for broader distribution.

INTRODUCTION

Early in 1959 the automobile manufacturing industry of the United States produced its 175-millionth motor vehicle. Seventy-five million were built during the last eleven years.

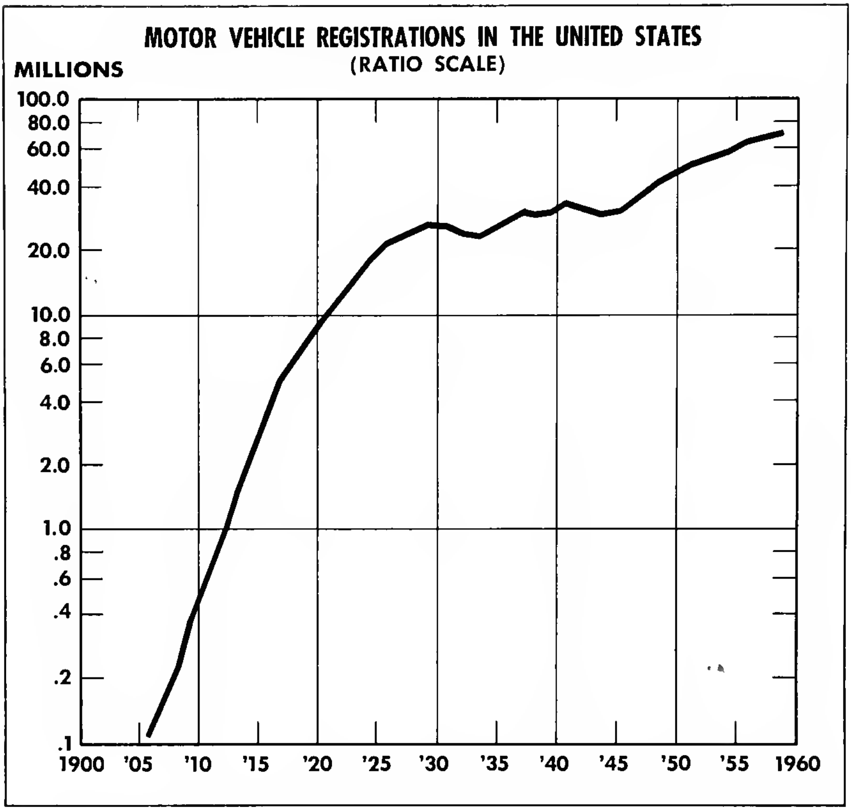
The following charts provide a quick look at the history of motor vehicle production and ownership in this country.



It will be seen that production has shown an impressive long-run growth over the period, although, in the short-run, fluctuations took place from year to year as a result of changing economic conditions. The effects of the depression in the 1930's and of World War II are clearly evident.

Motor vehicle ownership, as measured by vehicle registrations, has grown steadily over the same period—rather sharply in the earlier years and at a slower rate in later years as more people acquired vehicles and replacement demand became a more important market factor than new owner demand. The slight dip in the 1942 to 1945 period reflects the lack of production in those years and the restrictions on the sale of fuel during the period.

Motor trucks carry three-fourths of all freight loaded in this country and account for 12 percent of all ton-miles of freight hauled.



Employment in the plants of U. S. motor vehicle manufacturers now totals nearly half a million, with additional hundreds of thousands employed in the industries that supply parts and materials used in making motor vehicles.

The manufacture, sale, service, and commercial use of cars, trucks, and buses now involve more than 700,000 business enterprises and account for the gainful employment of more than ten million people.

More than 1,700,000 persons own stock in automobile and equipment manufacturing firms.

Capital expenditures by these firms since the end of the war have exceeded $11 billion.

We now have in this country a network of more than 3,500,000 miles of streets and highways.

These are but a few of the facts which show how the motor vehicle has transformed this country and brought to its people and its economy a mobility unlike anything in recorded history.

MARKETING OF MOTOR VEHICLES IN THE UNITED STATES

Consumer Oriented Economy

The American economy basically is consumer oriented. About two-thirds of the nation's output of goods and services represent expenditures on consumer goods. Fundamental to this type of economy are the following considerations.

1. Consumer needs and wants in our economy are increasingly diversified and specialized.
2. Most consumer goods markets are mass markets, resting solidly on a base of immense industrial productive capacity and a relatively broad distribution of high consumer incomes.
3. Vigorous competition is carried on for market acceptance among the very many producers of consumers' goods.
4. The market price mechanism performs a central function in the allocation of economic resources.

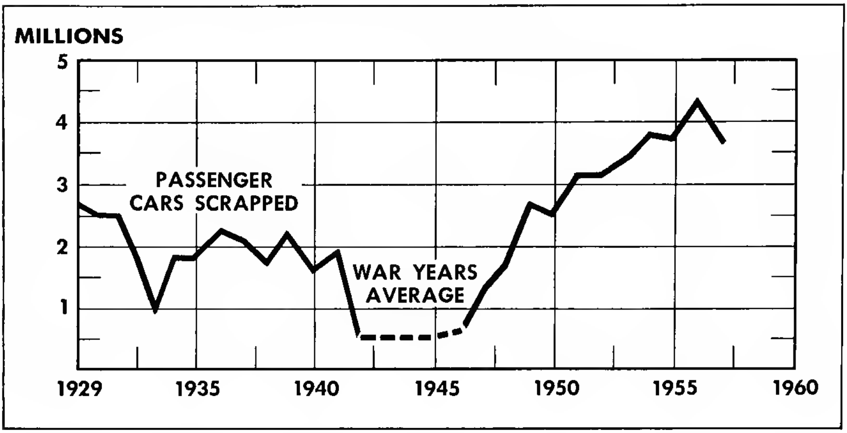
The American automobile industry early recognized the importance of developing a mass market, in order to support mass production and hence minimize costs and prices. Substantial research effort has been devoted to learning why people buy cars as well as when and where they buy.

The history of the industry has been one of continuous product development offering the buyer improvement in passenger safety and comfort, more powerful engines, more efficient braking, and better steering and suspension systems. Better lubricants, good roads, improved snow-removal equipment, and the ready availability of service stations have practically ended the reluctance of car owners to buy and drive cars during winter months. Although monthly sales fluctuations still exist, these have been moderated substantially by improved distribution and merchandising methods. Recent studies for 1953-1959 reveal about an 11 percent per year average reduction in the amplitude of seasonal variation in new car sales.

The practice of introducing new, improved models of our products annually has increased public interest in new car ownership and has stimulated car owners to purchase new cars at regular intervals. Cars traded-in by these new car purchasers are still relatively new—generally less than three years old. These "new" used cars are purchased at reduced prices by customers who in turn trade-in their still older models, and so on. This process of trading in an older car for a relatively newer one makes cars available at prices acceptable to every income group. This has made car ownership possible for practically every American adult. During any one year, there are at least two used cars traded for each new car sold.

Replacement Demand

Every year in the U. S. a number of cars are withdrawn from use and not reregistered. Such cars may have been destroyed in accidents, worn out beyond repair or simply put in storage. Statistically, these cars are "scrapped." The following chart shows the annual "scrappage" pattern and the relatively sharp increase of the postwar years.



However, prewar and postwar scrappage patterns are similar when average annual scrappage is expressed as a percentage of the average number of cars in use:

	Average Annual Scrappage	*Average Number Passenger Cars in Use as of Dec. 31*	*Scrappage as Percent of Cars in Use*
1931–1941	1,913,000	24,129,000	7.9%
1947–1957	3,069,000	43,891,000	7.0%

Scrappage reduces the number of cars in use, unless offset by an equal number of new car sales. Thus, manufacturers must produce each year at least the same number of cars that are scrapped just to maintain the stock of cars in use. Additional production is required to provide for increased ownership, for newly formed households, for multiple car ownership, and for the expanding needs of business and government. Fundamental to the demand and use of motor vehicles is the extent and quality of the Highway System in the United States.

The Highway System in the United States

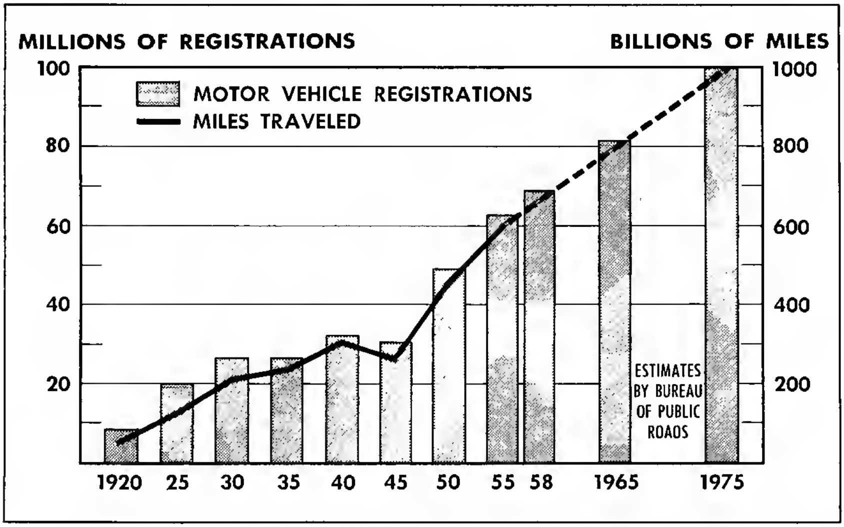
The widespread ownership of automobiles and the nation's network of roads have given Americans a mobility unknown in other countries. They drive their cars an average of nearly 10,000 miles per year. Although short trips are made generally—to and from work, shopping, and so forth—more than 60 percent of all trips over 500 miles are made by privately owned automobiles. Privately owned cars account for 88 percent of all inter-city passenger travel.

The automobile enables people to move from one area to another as job opportunities change. It permits people to live away from their place of work, and yet be able to get there quickly, to make social visits more easily and more frequently, to arrange business contacts more efficiently, and to take vacation trips more often.

At the end of 1957, more than 3,450,000 miles of state highways, local roads, and streets existed in the United States. This total mileage was composed of 3,064,000 miles in rural areas and 389,000 miles within municipalities. Nearly 66 percent of the rural roads and 90 percent of the municipal streets are surfaced.

During the 1930's, new construction and improvement of streets and highways proceeded at a relatively slow pace. During World War II it practically ceased. Then in the postwar years, as the production of new cars increased the country's total car ownership, it become obvious that the U. S. highway system was overcrowded.

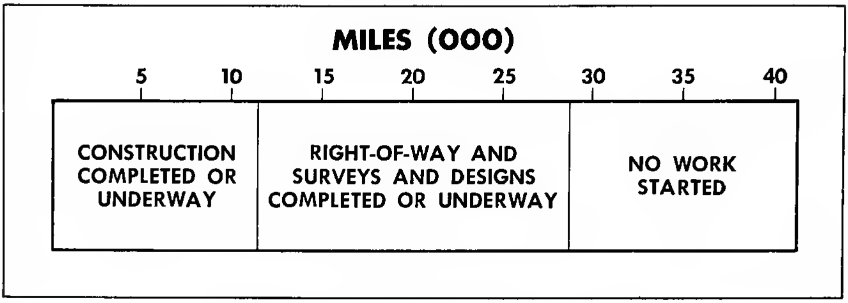
As shown in the following chart, motor vehicle ownership, or registrations, and miles traveled in this country have increased rapidly, especially in the postwar period.



Because of this growing need for more and better roads, the "Federal-Aid Highway Act of 1956" was enacted. This Act represents the most ambitious highway project ever undertaken in the U. S.

To meet the future needs of the nation, the present plan requires the completion of an interstate limited access highway system of 41,000 miles by 1971. The proposed Interstate Highway System will connect more than 90 percent of all cities with a population of 50,000 or more and will generally follow routes which now are in existence. Our highway needs today mainly concern traffic capacity and traffic safety.

The following chart shows the progress being made on the 41,000 mile Interstate Highway System. At the end of 1958, almost 11,500 miles of the System were completed or under construction.



Meeting Motor Vehicle Market Needs

To meet the many different market needs, each manufacturer strives to design and produce automobiles that offer the buyer increasingly greater value for his money year by year. Realizing that he cannot expect to satisfy all of the diverse consumer tastes and desires, he tries to satisfy enough of them to make his business grow and prosper. Since some customers want transportation at minimum cost, while others want the features and the prestige of higher priced makes, he offers a variety of cars covering a relatively wide price range. Since each body style has its adherents, cars come as convertibles, 2-door or 4-door sedans, hardtops, station wagons. Optional equipment such as automatic transmissions, radios, heaters, power brakes, power steering, power windows, engines with varying performance characteristics, cars in a variety of colors with matching upholstery are also available. By making this variety of choices available, the automobile manufacturer enlarges his potential market.

Retail automobile dealers, like the retailers of other goods, must keep on hand a variety of cars in various combinations of body styles, equipment, and colors to insure prompt delivery to consumers. Dealer inventories of new cars reach their peak early in the spring in anticipation of high demand and dwindle during summer months as they are sold and as production of current models is reduced preparatory to model change. Inventory levels as high as 900,000 units are not uncommon during peak selling periods of the year. By new model introduction time in the autumn, dealer inventories have generally been reduced to a few weeks' supply of the discontinued model cars.

The broad diversity of consumer needs and the openness of the American market to new product concepts is shown in the growth of sales in the U. S. of cars manufactured in foreign countries. In 1950 sales of imported cars were slightly more than 16,000 units. This year (1959) it is estimated foreign cars sold in the U. S. will total nearly 600,000 units.

Demographic Factors

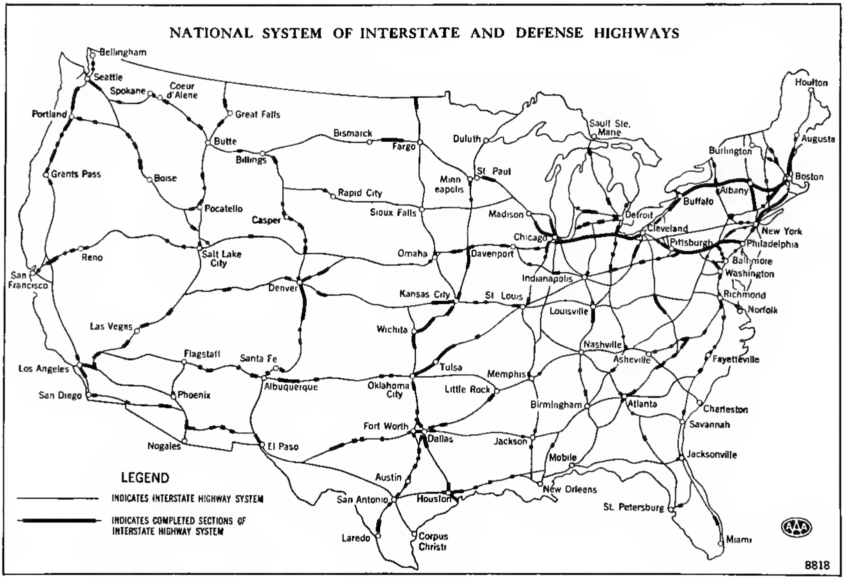
Growth of population and the number of households in the United States has been a strong contributory force to the demand for automobiles. Of itself, this growth does not insure increasing passenger car sales, but given a favorable environment, it does increase the potential demand for a variety of goods and services, including automobiles. Moreover, changes in population age groups and in the number of persons per family create changes in the aggregate demand for various goods.

In 1940, almost 20 percent of the U. S. population lived in the suburbs or in small towns outside the central cities of metropolitan areas. By 1950 this population increased to 23.3 percent; by 1955 it reached 27.4 percent. Between 1950 and 1955, the growth of these suburban areas accounted for more than 80 percent of the total U. S. population growth.

The need for personal automobile transportation is more urgent in suburban areas than in congested metropolitan areas. Cars in most cases are the only method of transportation, so that each household owns one or more. This has made suburban living possible, and suburban growth in turn has increased the demand for automobiles. Seventeen percent of suburban householders own two or more cars, compared to 12 percent in the entire country. Their transportation needs, travel to and from work, shopping, taking the family to church, children to school, and travel on recreational and social activities make private car ownership a necessity.

Income

Income is a basic determinant of passenger car demand. The comparatively high volume of new car sales since World War II has been supported by high employment levels and rising levels of personal income. Personal income after taxes (federal, state, and local), in terms of 1954 dollars, increased from $201.1 billion in 1947 to $295.2 billion in 1958, an increase of 46.8 percent in eleven years. Wages and salaries rose from


NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS

62.0 percent of national income in 1947 to 65.4 percent in 1958. Average hourly earnings of production workers in manufacturing, in terms of 1954 dollars, went from $1.47 in 1947 to $1.99 in 1958, an increase of 35.4 percent.

As average incomes rose, there was also a relative shift of consumer units from the lower to the middle and the upper income groups, as well as an absolute increase in the number of persons in these groups. The following table illustrates these changes:

Personal Income in 1958 Dollars (before income taxes)	*Number of Consumer Units (Millions)*		*Percent Distribution*	
	1947	*1958*	*1947*	*1958*
Under $4,000	20.8	19.7	47%	36%
$ 4,000–$5,999	11.6	13.6	26	25
$ 6,000–$7,999	5.8	9.2	13	17
$ 8,000–$9,999	2.8	5.0	6	9
$10,000 & over	3.7	6.8	8	13
Total	44.7	54.3	100	100

These higher income groups account for the major part of new car sales, so that an increase in their numbers strengthens the demand for new cars. This is illustrated as follows:

Annual Money Income	*Estimated Percent of New Car Purchasers–1957*
Under $5,000	20.0%
$5,000 to $7,499	32.2
$7,500 and over	47.8
All groups	100.0

Most used cars are purchased by families in the relatively lower income levels.

Annual Money Income	*Estimated Percent of Used Car Purchasers*
Under $5,000	56.3%
$5,000 to $7,499	29.1
$7,500 and over	14.6
All groups	100.0

Credit

The ready availability of instalment credit on acceptable terms has promoted among Americans the widespread ownership of both new and used passenger cars. Without instalment credit, the automobile industry could not have grown to its present size.

Beginning on a small scale in the early 1920's, the use of instalment credit to purchase automobiles grew rapidly, and now more than 60 percent of new passenger cars are sold on credit. Commercial banks and sales finance companies handle about 90 percent of the financing, with approximately equal shares for each group. The balance is handled by credit unions, small consumer and personal finance companies and automobile dealers. Some $16 billion of automobile credit is now held by all finance institutions. New credit extended for the purchase of automobiles varies from month to month, according to the volume of sales. So far this year it has ranged from $1.2 billion in January to $1.7 billion in July. Repayments have been at slightly lower levels, ranging from $1.2 billion in January to $1.3 billion in July 1959.

Franchised Passenger Car Dealers

U. S. car manufacturers sell virtually all of their products directly to independent retail dealers who, in turn, sell to the consumer and provide service facilities for the repair and maintenance of customer cars.

At present there are approximately 40,000 franchised new car dealers in the United States handling domestic and foreign make new cars, as well as the used cars received as trade-ins. In addition, there are a number of independent used car dealers who buy and sell used cars and trucks only, and who are not associated with a car manufacturer.

A new car dealer may handle one or more makes of cars, depending on the type of market (rural, urban, metropolitan) he serves, and the volume of sales needed to operate the business. The dealer usually furnishes his own capital, although in certain cases the manufacturer may assist him.

New Passenger Car Dealers' sales in 1957 were distributed as follows:

Department	*Percent of Total Sales*
New cars and trucks	56%
Used vehicles	27
Total service & parts	16
Miscellaneous sales	1
Total	100%

The total value of the investment in a dealership may range from less than $100,000 in a small community to more than a million dollars in a metropolitan area.

Banks and sales finance companies, in supplying credit to dealers who may have only modest personal resources, furnish the volume of working capital required to develop mass markets.

New car dealers vary in the size of their operations. In the larger markets many dealers sell several thousand new vehicles and perhaps twice as many used vehicles a year, while in smaller communities a dealer may sell less than a hundred vehicles, new and used combined, per year.

Automotive Parts and Accessories

It was earlier mentioned that automotive dealers' Service and Parts Departments accounted for 16 percent of dealers' total sales in 1957. The importance of these departments in keeping some 70 million vehicles in operating condition cannot be overemphasized. Consumers expect prompt replacement or repair in every part of the country of any worn-out parts which may cause their vehicles to be disabled. In addition to the service departments operated by the 40,000 new car dealers, service and repairs are offered by almost 80,000 independent repair establishments and 182,000 gasoline service stations (which provide lubrication and minor repairs as well as gasoline).

The wholesale value of parts and accessories sales to the United States market in 1957 amounted to $2 billion, 15.4 percent of the total wholesale value of all U. S. motor vehicle production. About 57 million replacement tires and 26 million replacement batteries are sold annually.

A substantial part of the total output of replacement parts and accessories is produced by independent companies, which sell their products both to the automotive manufacturers for installation on new vehicles or for resale, and to the market itself. Such companies include manufacturers of springs, wheels, electrical equipment, glass, upholstery, tires, batteries, brake fluid, and antifreeze. Their total number exceeds 2000.

Automobile and truck manufacturers maintain parts depots in various areas of the country from which parts are shipped to dealers to maintain and replenish their stock. Dealers must keep certain supplies on hand in order to give prompt customer service, but depend on parts depots for items which need replacement on a relatively infrequent basis. There are also over 12,000 independent wholesalers who maintain parts warehouses throughout the country to supply parts and accessories to independent retail automotive stores, as well as to new car dealers.

The Truck Industry

At the end of 1958, the U. S. had 43 percent (or 11.2 million) of all the trucks in the world. In the last five years, truck output in the U. S. has ranged from 0.9 million to 1.2 million units. During the same period, the U. S. has produced between 43 and 50 percent of the world's trucks.

	U. S. Truck Production	*World Truck Production*	*U. S. Percent Of World Truck Production*
1954	1,025,189	2,342,224	44
1955	1,249,576	2,518,700	50
1956	1,107,796	2,489,569	45
1957	1,096,446	2,534,077	43
1958	870,801	2,000,982	44
1959	1,121,372	n.a.	n.a.

A larger share of U. S. truck production is exported than is the case for passenger cars. About one of every five trucks produced is sold outside the U. S.

Percent of Cars and Trucks Produced That Have Gone Into the Export Market

	Cars	*Trucks*
1954	3.7	19.6
1955	3.2	15.9
1956	3.3	19.3
1957	2.6	19.9
1958	3.0	21.2
1959	2.1	17.7

The four main benefits of motor truck transportation are speed, economy, reliability, and convenience.

The majority of new trucks are sold through passenger car dealers—Chevrolet, Dodge, Ford and Studebaker. Truck manufacturers such as International, Mack, White, and Diamond T who do not manufacture passenger cars rely on their own outlets for truck sales.

About two out of every three trucks produced in the United States in 1959 had a light weight classification with a gross vehicle weight capacity of 10,000 pounds or less. The percentage distribution of truck production by weight classes is shown in the following table:

Total Truck Factory Sales in the U. S., 1959

Gross Vehicle Weight Class	*Units*	*Percentage Distribution*
Light (10,000 lb. & Less)	744,643	65.6%
Medium (10,001-16,000 lb.)	107,143	9.5
Heavy (Over 16,000 lb.)	283,059	24.9
Total	1,134,845	100.0

THE DECENTRALIZED STRUCTURE OF MOTOR VEHICLE MANUFACTURING AND DISTRIBUTION IN THE UNITED STATES

Practically all of the new cars produced in the United States are assembled by five firms (General Motors Corporation, Ford Motor Company, Chrysler Corporation, American Motors Corporation and Studebaker-Packard Corporation).

Four of the above car manufacturers also assemble trucks, as do such major firms as International Harvester Company, Divco-Wayne Corporation, Willys Motors, Inc., Mack Trucks, Inc. and The White Motor Company.

The business of manufacturing cars and trucks is more than assembling. As you know, engines, bodies, frames, electrical systems and the many nuts and bolts have to be precision manufactured beforehand. However, no manufacturer makes all of the parts and other components used in his products. Many are purchased from suppliers. Most of the auto manufacturers have their own engine plants. The larger companies that operate more than one engine facility usually locate them in different geographic areas of the U. S. On the other hand, every company purchases tires. In some cases, a company may manufacture half of its requirement for a component part and purchase the other half. In general, the decision to make or to buy depends primarily upon whether there is a difference in cost.

Decentralization—A Basic Requirement in this Industry

Decentralization of manufacturing activities and of managerial decisions has been an important cornerstone in the growth of the automotive industry. Without the flexibility gained through decentralization, it would be impossible to achieve a continuous flow of acceptable new products and innovations at relatively low cost.

The companies that assemble new cars and trucks are complex organizations attuned to high volume, low cost, mass production, and worldwide distribution. Capital requirements obviously are large. But these large operations still must depend on the flow of parts, materials and equipment from other businesses, many of which are relatively small but highly specialized and efficient in their field.

The manufacture of motor vehicles and equipment is both big and small business. In 1956, according to the Bureau of the Census, over 2,000 of the 2,340 firms had fewer than 250 employees each; over 1,500 firms employed less than fifty persons each.

The emphasis on specialization, decentralization, and manufacturing flexibility is not limited to automotive manufacturing. Producers of raw materials and semi-processed goods follow these principles. This is helpful not only to the vehicle manufacturer, but also to the total economy, because it tends to speed up shipments, keep down unit cost and encourage quality. These firms vie with each other when any manufacturer indicates an interest in purchasing materials or goods of the type they make. Because they have worked, many managerial practices developed by the automobile manufacturers have been adopted by other businesses.

Some of these businesses sell so much to the automobile manufacturers that they study the final automotive market and business practices nearly as intensively as do the manufacturers themselves. Other businesses depend heavily on selling and servicing automotive products.

In an average year, the retail value of new cars, trucks and buses and related parts and accessories is about $25 billion, or about 5 percent of the Gross National Product. The market for these important products provides employment not only for some one-half million men and women in the automobile companies, but also for hundreds of thousands in steel, glass, rubber and other supplying industries.

Capitalization

According to the data collected by the Federal Trade Commission and the Securities and Exchange Commission, corporations in the motor vehicles and equipment manufacturing industry are employing $16.3 billion worth of assets in their business (1st Quarter, 1959) of which $11.0 billion is represented by stockholders' investment. In 1947 these corporations employed $6.1 billion worth of assets in the business, including $4.1 billion stockholders' investment.

Property, plant and equipment in use in early 1959 were valued at $6.0 billion. The original cost was $11.5 billion but about $5.5 billion has been estimated to have depreciated. The replacement cost in today's prices obviously would be much higher than the $6.0 billion book value.

Inventories used in the business accounted for another $3.4 billion worth of the assets. Other current assets such as cash, accounts receivables, and U. S. Government securities amounted to $5.5 billion.

Short-term debt including tax accruals amounted to $3.9 billion. Long-term debt amounted to $1.9 billion.

The need for this tremendous capitalization may be better understood when related to the combined volume of sales by these corporations. In 1957 net sales amounted to $26.5 billion as compared to $10.7 billion in 1947. It would not be surprising if net sales reach $28 billion in 1959.

Financial and Capital Risks

It is evident that the funds invested in the automotive manufacturing industry are subject to greater than average financial risk.

Risk in the industry was discussed in considerable detail by automotive executives before a U. S. Senate Committee in February 1958. It was pointed out that the risks in the automobile business were extraordinarily great because of—

1. The rapid changes in styling and engineering features of the product brought about by intense competition.
2. The long period between styling, engineering, facility and tooling decisions and the sale to customers.
3. The large investments in styling, engineering, special facilities and tooling far ahead of sales.
4. The uncertainty as to what styling or product features will be most attractive to customers.
5. The long period required to correct mistakes in styling or product features—often two years.
6. The heavy losses if the product does not sell.

A succession of wrong product decisions could wreck a company. This is why companies offer big inducements to attract the best men to the top jobs where these decisions are made.

Automobile model changes, even relatively modest ones, require long lead times because of research, styling, engineering, tooling, facility, and manufacturing problems that are involved. In any given year, each company is working on product programs as far as four or five years away and on engineering research programs five to seven years in the future.

Tooling orders generally have been placed and most engineering completed fully two years or more before a new model is introduced. Preliminary package-size decisions have been made and basic styling themes, expressed in full-sized clay models, are completed more than three years ahead. Market analyses and preliminary styling renderings are under consideration four years in advance. In addition, engineering research is exploring developments to incorporate into models of five, six and seven years hence.

This four-year gestation period for new-model development (not counting engineering research) is unique to the automobile industry in the consumer-goods field. No other industry of comparable size faces such a long product-planning cycle for all of its models in every year.

In a typical new-model program, about 40 percent of the expenditures for tooling, engineering, styling and facilities are committed a full year before the first car is produced. It is very expensive to make major alterations in the program after this point, because work already done must otherwise be written off as a dead loss, and replacement work must be carried out on a high-cost "crash" basis.

Nevertheless, market requirements may change dramatically between the start of heavy spending on a new model program and the production date. Consumers' styling preferences shift unpredictably from round to flat, or blunt to sharp, or gaudy to austere. Various body styles rise and fall in popularity. Buying motives may be dominated by power in one year, economy in a second, size in a third, and style in a fourth. No manufacturer can guess right on these 100 percent of the time, especially when the guessing must start four years before the first sale. When it appears that his original guess is likely to be wrong, the producer has two alternatives:

1. Rush last-minute product changes at great expense, and hope the second guess is right;
2. It it is too late for that, or if the second guess is also wrong, take a licking in the market.

Neither alternative is pleasant; yet, no producer has been able to avoid at least an occasional year of wrong-guessing. Conversely, when any producer succeeds in bringing out a particularly attractive product, his sales and profits will increase sharply. This is the essence of the profit and loss system.

Decentralization of Management

How do the automotive manufacturing companies make sure that the drive for lower costs, improved product quality, and profitability never ceases? Decentralization of managerial decisions is part of the answer. But how do the companies make sure that the decisions are made wisely? Obviously, there is no 100 percent guarantee that all decisions will be the best. However, a system by which management compensation depends largely upon successful performance has been widely adopted in this industry.

A performance yardstick is also made possible by decentralizing a large complex organization into smaller profit centers. Each is run like an independent business whose performance can be measured and compared. Obviously, this process requires delegation of responsibility to managers and the authority to carry out these responsibilities. The incentive system, mentioned earlier, provides the best means devised so far, to insure that the results we are trying to achieve will be achieved. Internal competition is used as a spur by encouraging each profit center to compare its incentive awards with others and understand why differences exist.

The heart of the performance yardstick is a comprehensive operations control system. Ultimate success depends heavily on sound planning and reporting. You must know (1) where you have been, (2) where you are, and (3) where you are planning to go. Forecasts based on an average volume of activity can be useful long term guides.

In this industry, long-range facilities planning by a company means analyzing the market for its products over a certain period of years, determining what percentage of the market it thinks it can get, determining the type of products that will be characteristic of those years, and translating those findings into plant requirements.

Plant capacity, i.e., measured rate of output, in turn has a material influence on costs, particularly tooling costs. All of the companies have highly developed systems of cost control. A cost control system operates as a spur to every plant manager and foreman to analyze his operations continuously to determine whether more modern methods and machinery will do the job more efficiently.

The success of each business depends ultimately on sound financial planning and reporting. A financial control system must have a clear objective—a yardstick against which to measure performance.

At the beginning of each year the manager of each profit center usually submits a budget for that year based upon an estimated rate of production. Such budgets are reviewed individually with each manager and his principal assistants. Expense budgets of organizations that are not profit centers, such as those covering administrative and commercial expenses, engineering, and so on normally are submitted annually and reviewed thoroughly in the same manner.

In addition to the actual monthly and year-to-date profit statements, most companies require all operations to furnish a forecast covering the next four to six months, based upon the expected performance at anticipated volume. This is done each month.

Under the profit center system, revenue control of intracompany sales between various divisions of the same firm gives invaluable guidance in make-or-buy decisions, provides a check on supplier prices, and is a useful test of performance.

Decentralization of Distribution

So far this paper has described how a decentralized program works in large manufacturing organizations. What happens in the distribution system is an extension to retailing of this principle of decentralization. By owning his business the dealer is also on an incentive system in competition with other dealers.

The many thousands of new car dealers order new cars from the manufacturer based on their intimate knowledge of their own local market. In total, these dealers have billions of dollars invested in facilities, inventories, and parts. Each dealer knows from experience that he must be able to sell the new products quickly and efficiently if he is to show any return on his investment and time. He must also cultivate a satisfied customer clientele. This involves provision for servicing and maintenance of consumers' cars. Throughout, he must carry an adequate inventory to insure prompt customer delivery.

The automobile market requires wide geographic dispersion and operational flexibility of service facilities. Such facilities, experience has shown, are best made up of many relatively small and individually owned establishments.

SOME ECONOMIC CONSIDERATIONS ON MECHANIZATION

"Automation"

In discussing the subject popularly termed "automation", we face a difficulty of definition, because the term has no precise universal meaning. Some use the term to mean only the use of material handling and transfer equipment. Others use it to mean the use of automatic machinery and equipment with self-activating controls. An automatic screw machine is a good example of this type of mechanism. You will see numerous examples of this throughout the industry's manufacturing operations. Then there are the so-called "closed production systems", in which all of the operations, including transfer from one work station to another, are controlled by "feed-backs", i.e., the variations in the system itself become self-actuating. The broadest definition of the term is simply the substitution of mechanical power and controls for human energy and control wherever it will improve the efficiency of the productive process.

Watt's invention of the steam engine began the era of mechanical progress throughout the world. Its most obvious contribution has been to reduce the cost of transportation, previously mostly water-borne. The development of mechanical rail and later highway overland transportation was one of the greatest contributions to rising living standards. The net effect has probably been to reduce the real cost of transportation of goods by as much as 90 percent, in terms of human effort.

American automobile manufacturers have been in the forefront in the maximum use of capital for the purpose of increasing efficiency and productivity of manufacturing processes. The assembly line principle was adopted very early by the car manufacturers. As new devices were developed which substituted mechanical power and accuracy for human energy and human limitations in control of processes, they very frequently had their first applications in the automobile manufacturing plants. As the allowable mechanical limits of accuracy in manufacturing have been reduced progressively, more machinery, and more expensive machinery, has had to be employed to maintain production at the required rate within the new limits that are so far beyond the range of individual human control.

The prime motivation in this relentless drive to improve efficiency, i.e., to lower costs, has been the profit incentive. In a competitive economy the only way a producer can increase unit profit without loss of volume is by reducing unit costs, not by raising prices. Therefore, there exists a continuous drive to reduce costs by all means available, of which added investment in more productive machinery and equipment is the most obvious manifestation.

The key elements of this problem of determining when additional investments in mechanization are justified are four: How many units of production will be needed in terms of the rate per hour, per day, per month and per year; what the cost is under the existing process, at these rates; what the saving would be by the new process, including a full depreciation of an adequate return on the added investment; and whether the additional capital is available at a satisfactory interest rate. All decisions to mechanize a given process further hinge upon the answer to these four questions.

Furthermore, these answers are never static. The decision not to mechanize additionally at any one time may be the right answer. Within a short while, however, it may prove to be the wrong answer because of a new development which greatly increases the possible savings by additional mechanization. Hence, all of these decisions must be reconsidered at periodic intervals to make certain that no opportunity to achieve increased efficiency is lost by oversight.

Progress in the development of new methods for production at lower cost through the use of more efficient equipment, better plant layout, employe training programs, etc., has been accompanied by a parallel stream of progress in the design of the product itself. But advances in product design can only be made available to the public by discontinuing production of the old product and reorganizing production equipment to produce the improved model. Experience indicates that major improvements in automobiles cannot be economically introduced more frequently than once a year. On the other hand, delaying the changes for longer than a year in a competitive mass market can easily cause the manufacturer to lose more from reduced sales than he would save in production costs from continued production of the same product for a longer period of time. This is to say that if a product is standardized and there are no improvements available to be introduced, automatic production can be carried out more economically and for a longer period of time than is possible if product improvements are being introduced at frequent intervals. Thus, the more complete the degree of "automation" of the process, the more rigid and hence the less adaptable to change it becomes, and the more costly the change is when it must be made.

The problem of management, therefore, is to obtain a satisfactory balance between the economies available through the use of automatic equipment and the benefits resulting from the ability to remain flexible enough in the production complex to improve products at regular intervals.